LUMO level and a third HOMO level, wherein each region comprises one or more monomers and the quantity and arrangement of the monomers in the organic polymer is selected so that the first, second and third bandgaps are distinct from one another in the polymer, and wherein the device includes an emissive material which may or may not be the third region, and the first LUMO level lies between a work function of the cathode and a LUMO level of the emissive material or which is matched to the LUMO level of the emissive material, and the second HOMO level lies between a work function of the anode and a HOMO level of the emissive material or which is matched to the HOMO level of the emissive material.

THE AMENDED SPECIFICATION:

Applicant has added the section headings on pages 1, 4, and 8 as requested by the Examiner.

Applicant has deleted a reference to GB Application No. 9925653.9 on pages 26-27 as not essential material. Rather, the specification itself describes the designated "several different polymerization methods" referred to on page 26, second to the last paragraph. In particular, see pages 27-28 and the examples 1-6 on pages 30-38.

Thus, the specification is now believed to be in condition for allowance.

RESPONSE TO § 112 REJECTIONS

Claim 42 has been amended to independent form to include the subject matter of claim 1, as well as the subject matter of prior claim 42. This has eliminated the typographical error.

Claims 43, 45 and 48 have been amended to delete the objected to language "is capable of generating" in a manner which is believed to be more definite. Support for this amendment is found for example on page 6, final paragraph.

Claim 41 has been amended to depend on claim 6. This is believed to overcome the improper form objection.

Claim 56 has been amended to depend from claim 55 in order to overcome the objection of failing to further limit.

Thus, the present claims are believed to overcome the § 112 rejections.

RESPONSE TO PATENTABILITY OBJECTIONS

Claims 1, 2, 18, 55, and 63-65 were rejected as anticipated by WO 96/20253 to Holmes et al. Holmes is addressed to semiconductive polymers which are luminescent and which are subjected to cross-linking. Holmes does teach that such polymers may have charge transporting segments and electroluminescent segments, as noted by the Examiner. Holmes indicates that these segments may be pendant to the main chain of the polymer or that they may be in the main chain of the polymer, with an emphasis that there are preferably flexible spacers between such segments.

The various aspects of Applicant's invention set forth in the specification clearly teach significantly more about polymer design as it relates to device construction then does the Holmes patent. In new claim 117, Applicant emphasizes these differences.

New claim 117 is based on original device claim 65 and includes the organic polymer of original claim 1. New claim 117 further specifies selected work functions of the anode and cathode and the HOMO and LUMO levels of an emissive material (which may be the third region). More specifically, claim 117 specifies, as described on page 9

lines 2-5, that the first LUMO level lies between a work function of the cathode and a LUMO level of the emissive material or which is matched to the LUMO level of the emissive material. Further, as specified on page 10 lines 6-10, the second HOMO level lies between a work function of the anode and a HOMO level of the emissive material or which is matched to the HOMO level of the emissive material.

In contrast, Holmes contains no teaching that the components for hole transport and electron transport should be selected using the work functions of the anode and the cathode and the HOMO and LUMO levels of the emissive materials as a guide. Thus, Applicant respectfully asserts that claim 117 patentably distinguishes over the cited reference.

Applicant has amended claim 42 to be an independent claim based on original claim 1, but specifying the inclusion of all three regions. Holmes does not teach or suggest the use of two distinct charge transporting segments, together with a separate luminescent segment. There being no teaching or suggestion of this in the prior art, Applicant respectfully asserts that claim 42 is patentable.

Claim 1 has been amended to specify that there is no cross-linking functionality on the polymer. This distinguishes the Holmes patent. Holmes is addressed to semiconductive polymers which are luminescent and which are subjected to cross-linking. Further, Holmes fails to teach or suggest selecting of components to provide specific HOMO, LUMO and bandgaps that are distinct for each of the three regions now recited in amended claim 1. Thus, claim 1 is believed to patentably distinguish over the cited reference.

Thus, Applicant respectfully requests allowance of claims 1-65 and 117.

NEW CLAIMS 66-116

Applicant submits the following new claims, based upon the previously held allowable claims 3-17, 19-40, 44, 46-47, 49-54, and 57-62. The correspondence between the old and new claims is set forth in the following chart:

OLD	NEW
3-17	66-79
19-28	80-89
29-38	90-99
39-40	100-101
44	102
46-47	103-104
49-54	105-110
57-62	111-116

SUPPLEMENTAL IDS

Applicant submits herewith a supplemental IDS referencing three U.S. patents. One of these patents, U.S. Patent 5,998,045, was included in the Examiner's Notice of References Cited in the August 22, 2002 Office Action.

In view of the foregoing amendments and remarks, Applicant respectfully requests the reconsideration and reexamination of this application and the timely allowance of the pending claims.

Please grant any extensions of time required to enter this response and charge any additional required fees to our deposit account 06-0916.

Respectfully submitted,

FINNEGAN, HENDERSON, FARABOW,
GARRETT & DUNNER, L.L.P.

Dated: February 24, 2003

By: Therese A. Hendricks
Therese A. Hendricks
Reg. No. 30,389

APPENDIX
VERSION SHOWING MARKED UP CHANGES

1. (Amended) An organic polymer having a plurality of regions along the length of the polymer backbone and comprising two or more of the following:

(i) a first region for transporting negative charge carriers and having a first bandgap defined by a first LUMO level and a first HOMO level; and

(ii) a second region for transporting positive charge carriers and having a second bandgap defined by a second LUMO level and a second HOMO level; and

(iii) a third region for accepting and combining positive and negative charge carriers to generate light and having a third bandgap defined by a third LUMO level and a third HOMO level;[,]

wherein each region comprises one or more monomers and the quantity and arrangement of the monomers in the organic polymer is selected so that the first, second and third bandgaps are distinct from one another in the polymer, and wherein there is no cross-linking functionality on the polymer.

41. (Twice Amended) An organic polymer according to claim 6, wherein the second region additionally comprises a fifth monomer comprising a further second monomer as defined in [any one of claims 6 to 17] claim 6, which is different from the second monomer.

42. (Twice Amended) An organic polymer [according to claim 1 and comprising all three regions] having a plurality of regions along the length of the polymer backbone and comprising all three of the following:

(i) a first region for transporting negative charge carriers and having a first bandgap defined by a first LUMO level and a first HOMO level; and

(ii) a second region for transporting positive charge carriers and having a second bandgap defined by a second LUMO level and a second HOMO level; and

(iii) a third region for accepting and combining positive and negative charge carriers to generate light and having a third bandgap defined by a third LUMO level and a third HOMO level;(,)

wherein each region comprises one or more monomers and the quantity and arrangement of the monomers in the organic polymer is selected so that the first, second and third bandgaps are distinct from one another in the polymer.

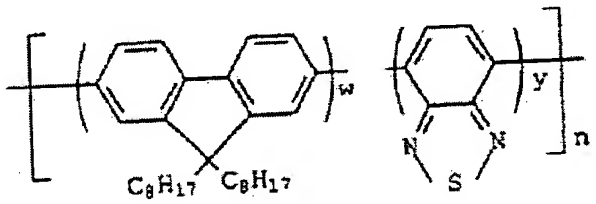
43. (Amended) An organic polymer according to claim 42, wherein the third region [is capable of generating] is in a layer between the anode and the cathode and when a voltage is applied emits light with a wavelength in the range 600 nm to 700 nm.

45. (Amended) An organic polymer according to claim 42, wherein the third monomer [is capable of generating] light having a wavelength in the range 500 nm to 600 nm.

48. (Amended) An organic polymer according to claim 42, wherein the third monomer[is capable of generating] is in a layer between the anode and the cathode and

when a voltage is applied emits light having a wavelength in the range 400 nm to 500 nm.

56. An organic polymer according to claim [65] 55, having a formula as shown in Formula XXXVI:



(XXXVI

wherein w + y = 1, w ≥ 0.5 and y ≤ 0.5 and n ≥ 2.

66. (New) An organic polymer having a plurality of regions along the length of the polymer backbone and comprising two or more of the following:

(i) a first region for transporting negative charge carriers and having a first bandgap defined by a first LUMO level and a first HOMO level; and

(ii) a second region for transporting positive charge carriers and having a second bandgap defined by a second LUMO level and a second HOMO level; and

(iii) a third region for accepting and combining positive and negative charge carriers to generate light and having a third bandgap defined by a third LUMO level and a third HOMO level,

wherein each region comprises one or more monomers and the quantity and arrangement of the monomers in the organic polymer is selected so that the first, second and third bandgaps are distinct from one another in the polymer, and wherein the first region comprises a first monomer comprising a substituted or unsubstituted fluorene group.

67. (New) An organic polymer according to claim 66, wherein the first monomer comprises a 2,7- linked dialkyl fluorene group.

68. (New) An organic polymer according to claim 67, wherein the 2,7- linked dialkyl fluorene group is a 9,9 dioctyl flourene group.

69. (New) An organic polymer according to claim 66, wherein the second region comprises a second monomer comprising a substituted or unsubstituted aromatic or heteroaromatic group.

70. (New) An organic polymer according to claim 69, wherein the second monomer comprises a triarylamine unit having the general formula $-[Ar_3N]-$ wherein each Ar is the same or different and comprises a substituted or unsubstituted aromatic or heteroaromatic group.

71. (New) An organic polymer according to claim 69, wherein at least one Ar comprises a substituted or unsubstituted phenyl group.

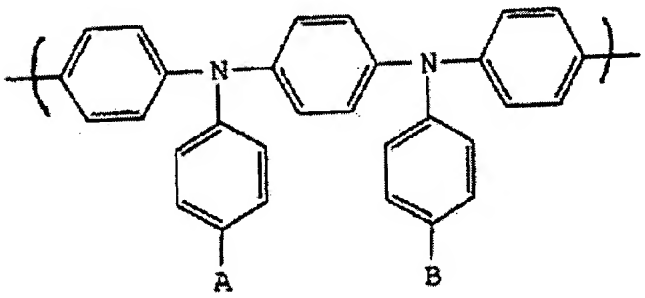
72. (New) An organic polymer according to claim 70, wherein at least one Ar comprises a substituted or unsubstituted aromatic or heteroaromatic side group that is pendent to the polymer backbone.

73. (New) An organic polymer according to claim 72, wherein the side group comprises a substituted or unsubstituted aryl group.

74. (New) An organic polymer according to claim 73, wherein the side group comprises an unsubstituted phenyl or a monosubstituted or 3,5-disubstituted phenyl group.

75. (New) An organic polymer according to claim 72 wherein the side group has a subsitutent group comprising a substituted or unsubstituted alkyl, perfluoroalkyl, alkylaryl, arylalkyl, heteroaryl, aryl, alkoxy, thioalkyl or cyano group.

76. (New) An organic polymer according to claim 75, wherein the triarylamine unit comprises a group having a formula as shown in any one of Formulas IV, V or VI:



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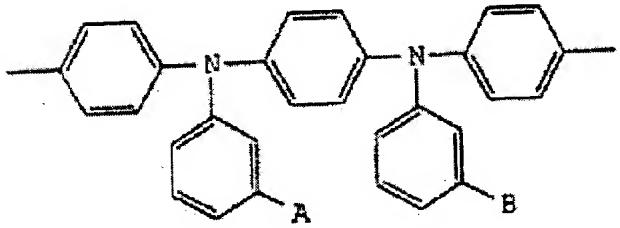

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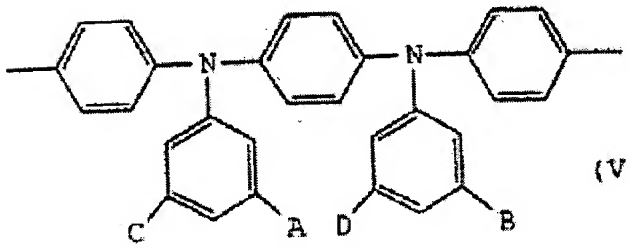


(VI)

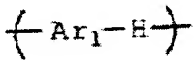
77. (New) An organic polymer according to claim 75, wherein one or more of X, Y, A, B, C and D is independently selected from the group consisting of hydrogen, alkyl, aryl, perfluoroalkyl, thioalkyl, cyano, alkoxy, heteroaryl, alkylaryl, and arylalkyl groups.

78. (New) An organic polymer according to claim 77, wherein one or more of X, Y, A, B, C and D is independently selected from the group consisting of an unsubstituted, isobutyl group, an n-alkyl, an n-alkoxy or a trifluoromethyl group.

79. (New) An organic polymer according to claim 77, wherein X and Y or A, B, C and D are the same.

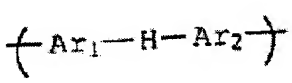
80. (New) An organic polymer according to claim 1, wherein the third region comprises a third monomer comprising a group H which is an aromatic or heteroaromatic diazine group fused to a benzene or thiophene group.

81. (New) An organic polymer according to claim 80, wherein the third monomer comprises a group having a formula as shown in Formula IX:



wherein Ar_1 is a substituted or unsubstituted aromatic or heteroaromatic group.

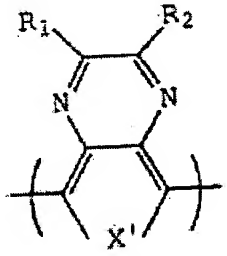
82. (New) An organic polymer according to claim 81, wherein the third monomer comprises a group having a formula as shown in Formula X:



wherein Ar_2 is a substituted aromatic or heteroaromatic group and Ar_1 is as defined in claim 20.

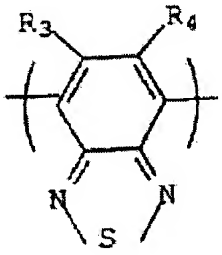
83. (New) An organic polymer according to claim 81, wherein Ar_1 or Ar_2 independently comprises a substituted or unsubstituted, fused or unfused benzene, thiophene, furan, quinoxaline, biphenyl or fluorene group.

84. (New) An organic polymer according to claim 80, wherein the third monomer comprises a group having a formula as shown in Formula VIII:



wherein X' is RC=CR or S and R_1 and R_2 are the same or different and are each a substituent group.

85. (New) An organic polymer according to claim 80 wherein the third monomer comprises a group having a formula as shown in Formula XI:

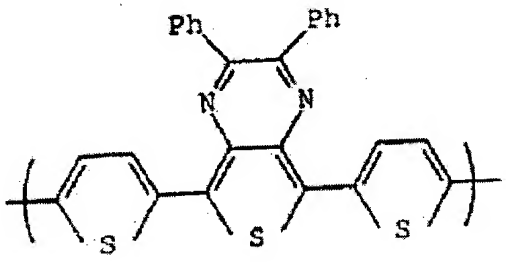


wherein R_3 and R_4 are the same or different and are each independently a substituent group.

86. (New) An organic polymer according to claim 84, wherein one or more of R_1 ,R_2, R_3, and R_4 is each independently selected from hydrogen, alkyl, aryl, perfluoroalkyl, thioalkyl, cyano, alkoxy, heteroaryl, alkylaryl, arylalkyl, pyridine or furan.

87. (New) An organic polymer according to claim 86, wherein R_1 and R_2 or R_3 and R_4 are the same and are each a phenyl group.

88. (New) An organic polymer according to any one of claim 84, wherein the third monomer comprises a group having a formula as shown in any one of Formulas XIII to XVII:



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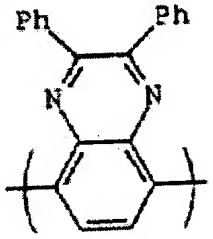

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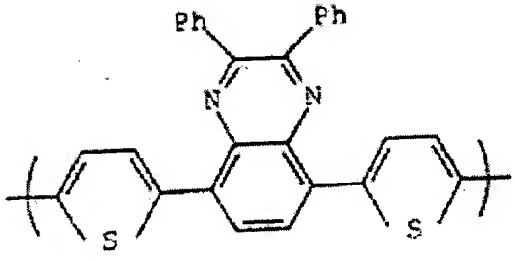

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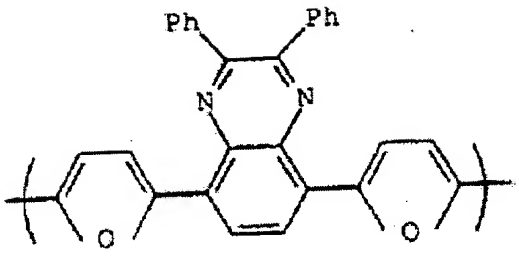

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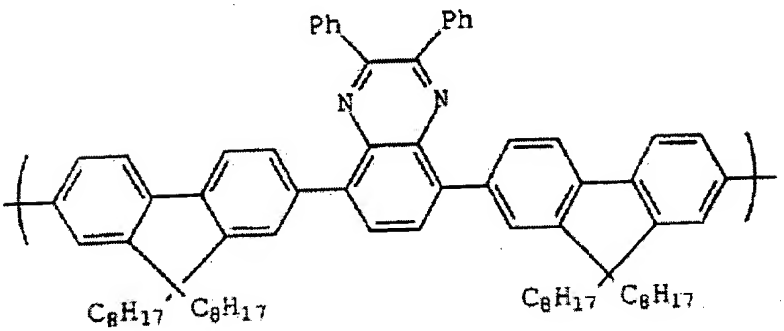
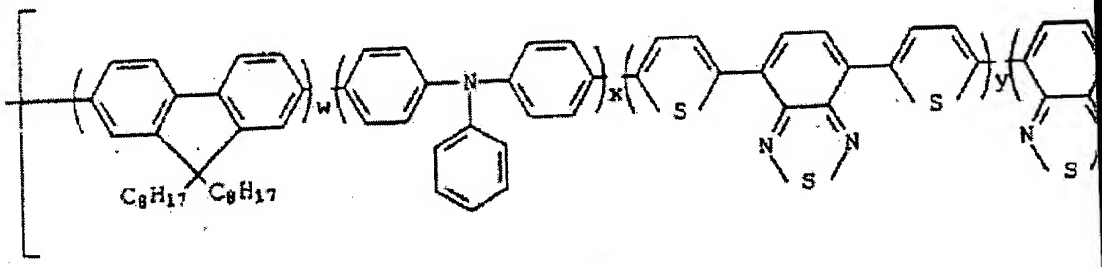
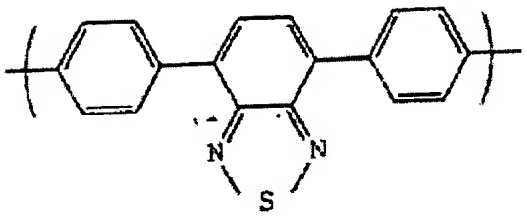


(XVII)

89. (New) An organic polymer according to claim 84, wherein the third monomer comprises a group having a formula as shown in any one of Formulas XVIII to XXVI:



XXVIII



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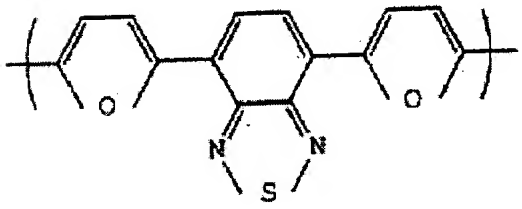

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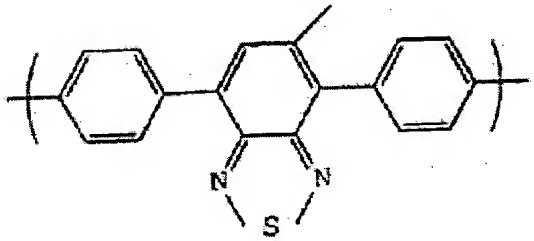

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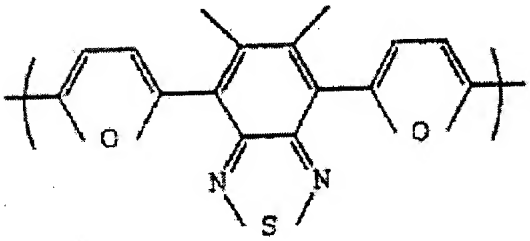

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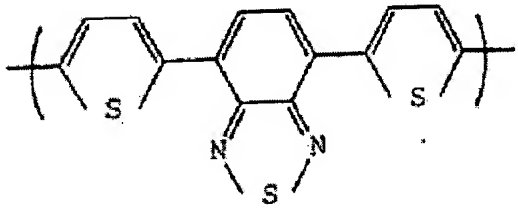

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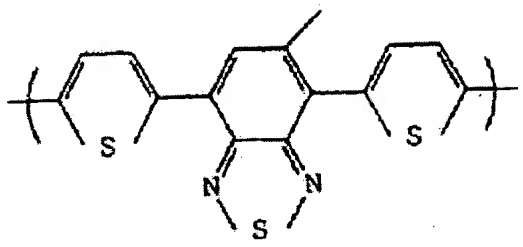

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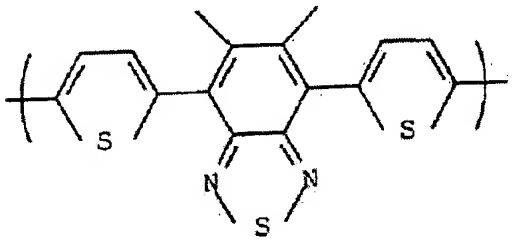
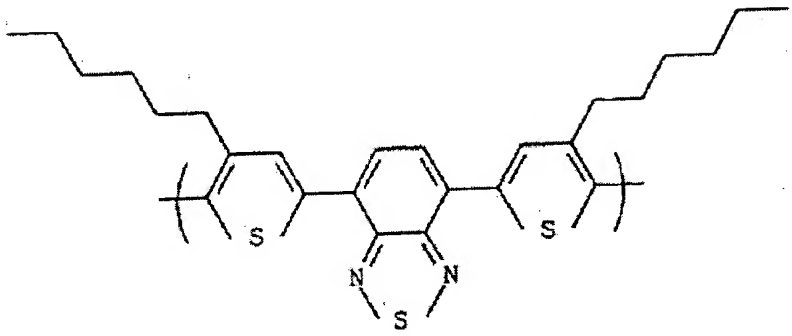




(XX

90. (New) An organic polymer having a plurality of regions along the length of the polymer backbone and comprising two or more of the following:

(i) a first region for transporting negative charge carriers and having a first bandgap defined by a first LUMO level and a first HOMO level; and

(ii) a second region for transporting positive charge carriers and having a second bandgap defined by a second LUMO level and a second HOMO level; and

(iii) a third region for accepting and combining positive and negative charge carriers to generate light and having a third bandgap defined by a third LUMO

level and a third HOMO level, wherein each region comprises one or more monomers and the quantity and arrangement of the monomers in the organic polymer is selected so that the first, second and third bandgaps are distinct from one another in the polymer, wherein the third region comprises a third monomer comprising a triarylamine unit.

91. (New) An organic polymer according to claim 90, wherein the third monomer comprises a group having the formula ~~[~~(-Ar_2N-) -Ar-(-NAr_2-)~~]~~, wherein each Ar is the same or different and comprises a substituted or unsubstituted aromatic or hteteroaromatic group.

92. (New) An organic polymer according to claim 91, wherein at leat one Ar comprises a substituted or unsubstituted aryl group.

93. (New) An organic polymer according to claim 92, wherein the at least one Ar comprises an unsubstituted phenyl group.

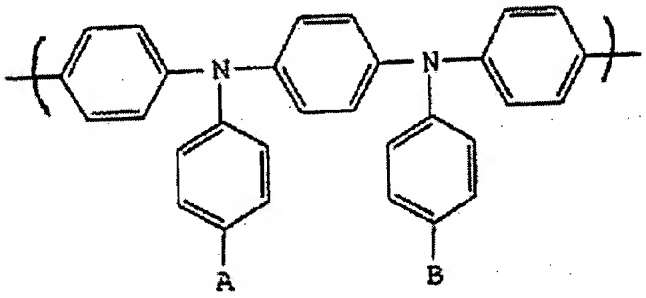
94. (New) An organic polymer according to any one of claim 91, wherein at least one Ar comprises a substituted or unsubstituted aromatic or heteroaromatic side group that is pendent to the polymer backbone.

95. (New) An organic polymer according to claim 94, wherein the side group comprises fused or unfused benzene, thiophene, furan, quinoxaline, biphenyl or fluorene group.

96. (New) An organic polymer according to claim 95, wherein the side group comprises a monosubstitued phenyl group.

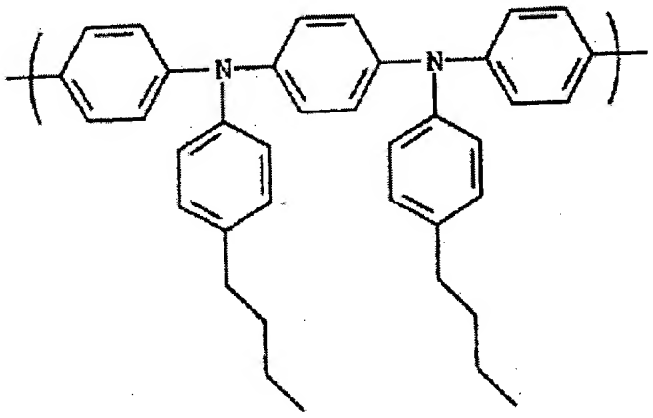
97. (New) An organic polymer according to claim 94, wherein the side group has a substituent group comprising hydrogen or a substituted or unsubstituted alkyl, perfluoroalkyl, alkylaryl, arylalkyl, heteroaryl, aryl, alkoxy, thioalkyl or cyano group.

98. (New) An organic polymer according to claim 97, wherein the triarylamine unit comprises a group having a formula as shown in Formula IV



wherein A and B are the same or different and are substituent groups.

99 (New) An organic polymer according to claim 98, wherein the third monomer comprises a group having a formula as shown in Formula XXVII:



100. (New) An organic polymer having a plurality of regions along the length of the polymer backbone and comprising two or more of the following:

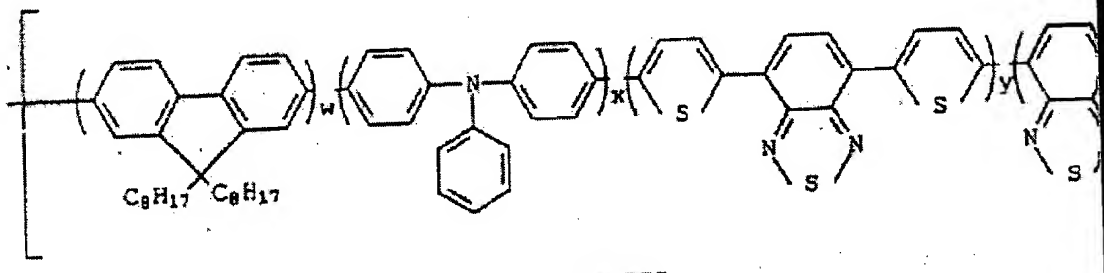
(i) a first region for transporting negative charge carriers and having a first bandgap defined by a first LUMO level and a first HOMO level; and

(ii) a second region for transporting positive charge carriers and having a second bandgap defined by a second LUMO level and a second HOMO level; and

(iii) a third region for accepting and combining positive and negative charge carriers to generate light and having a third bandgap defined by a third LUMO level and a third HOMO level, wherein each region comprises one or more monomers and the quantity and arrangement of the monomers in the organic polymer is selected so that the first, second and third bandgaps are distinct from one another in the polymer, wherein the first region additionally comprises a fourth monomer comprising a further substituted or unsubstituted aromatic or heteroaromatic group.

101. (New) An organic polymer according to claim 100 wherein the further substituted or unsubstituted aromatic or heteroaromatic group comprises a group as shown in formula XI wherein R_3 and R_4 are both hydrogen.

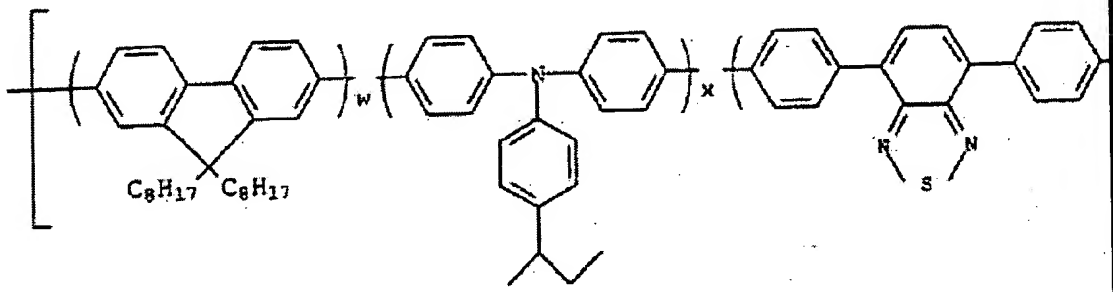
102. (New) An organic polymer according to claim 1 and comprising all three regions, and having a formula as shown in Formula XXVIII:



XXVIII

wherein $w + x + y + z = 1$, $w \geq 0.5$, $0 \leq x + y + z \leq 0.5$ and $n \geq z$.

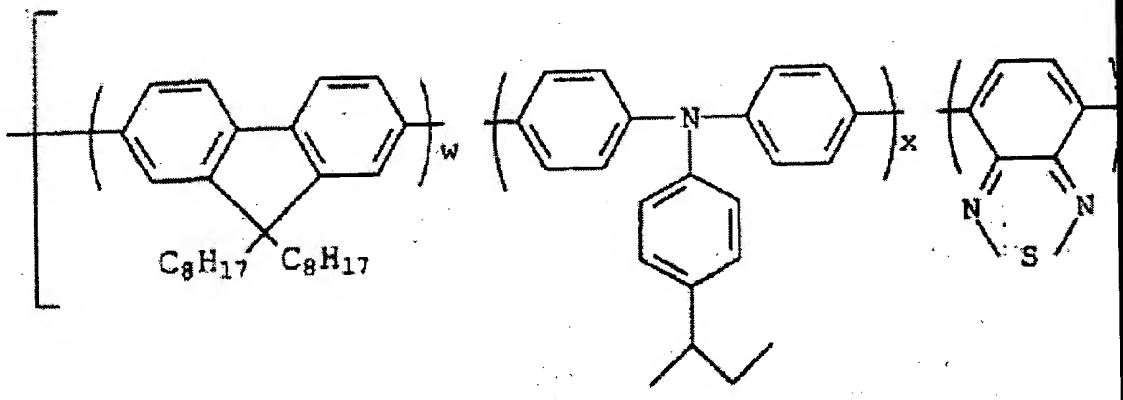
103. (New) An organic polymer according to claim 1 and comprising all three regions and having a formula as shown in Formula XXIX:



(XXIX)

wherein $w + x + y = 1$, $w \geq 0.5$, $0 \leq x + y \leq 0.5$ and $n \geq 2$.

104. (New) An organic polymer according to claim 1 and comprising all three regions and having a formula as shown in Formula XXX:

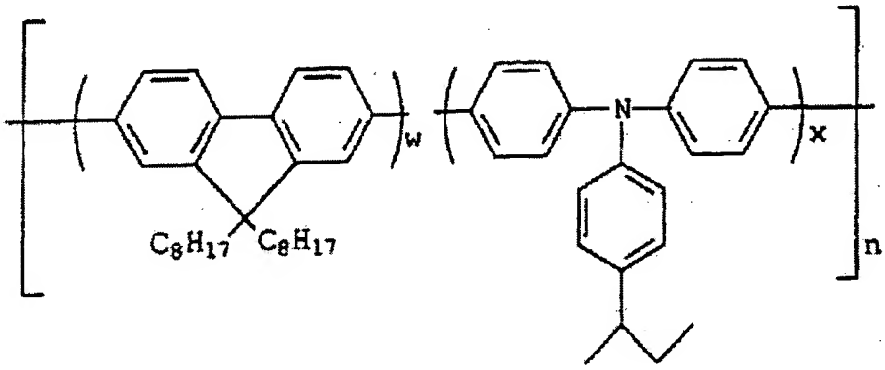


(XXX)

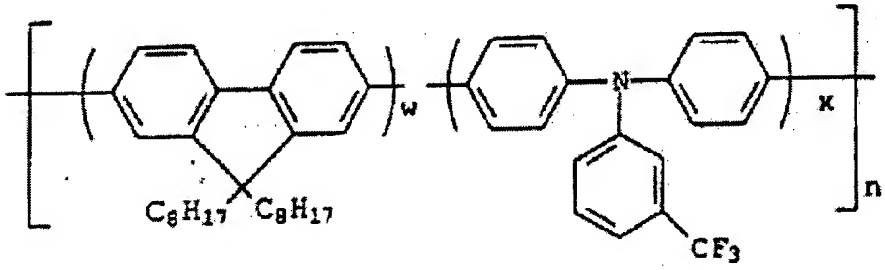
wherein $w + x + y = 1$, $w \geq 0.5$, $0 \leq x + y \leq 0.5$ and $n \geq 2$.

105. (New) An organic polymer according to claim 1, and comprising the first and second regions.

106. (New) An organic polymer according to claim 105, having a formula as shown in Formula XXXII or XXXIII:



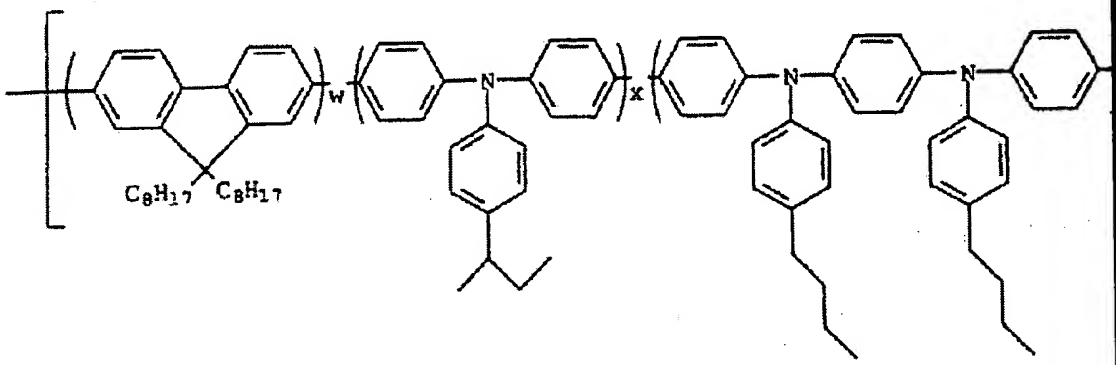
(XX



(X

wherein $w + x = 1$, $w \geq 0.5$, $x \leq 0.5$ and $n \geq 2$.

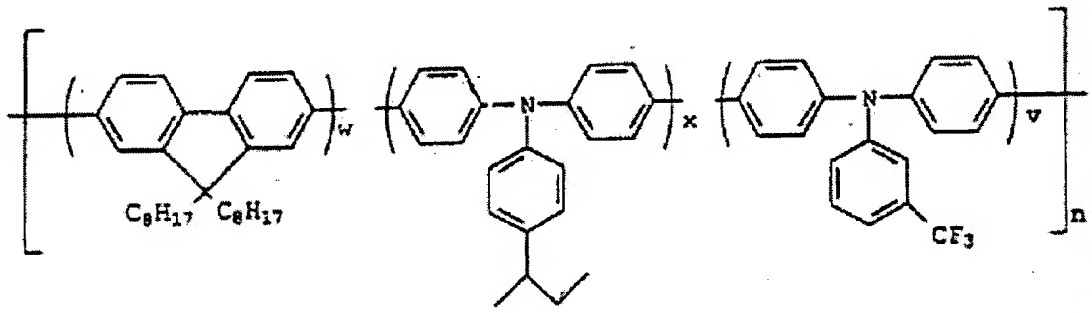
107. (New) An organic polymer according to claim 106, having a formula as shown in Formula XXXI:



(XXXI)

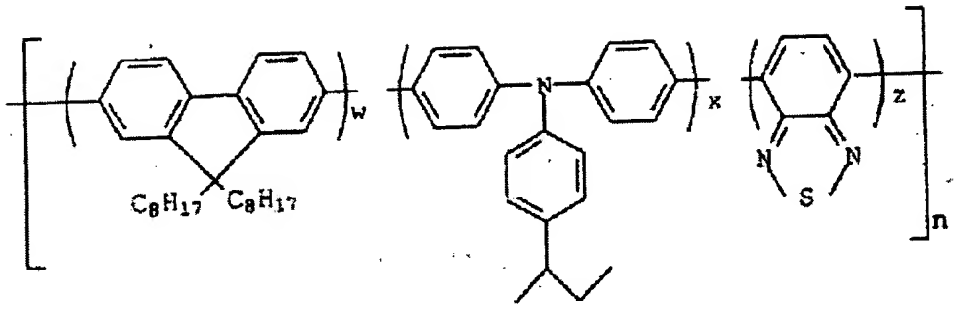
wherein $w + x + y = 1$, $w \geq 0.5$, $0 \leq x + y \leq 0.5$ and $n \geq 2$.

108. (New) An organic polymer according to claim 105, having a formula as shown in Formula XXXIV:



wherein $w + x + v = 1$, $w \geq 0.5$, $0 \leq x + v \leq 0.5$ and $n \geq 2$.

109. (New) An organic polymer according to claim 105, having a formula as shown in Formula XXXV:



wherein $w + x + z = 1$, $w \geq 0.5$, $0 \leq x + z \leq 0.5$ and $n \geq 2$.

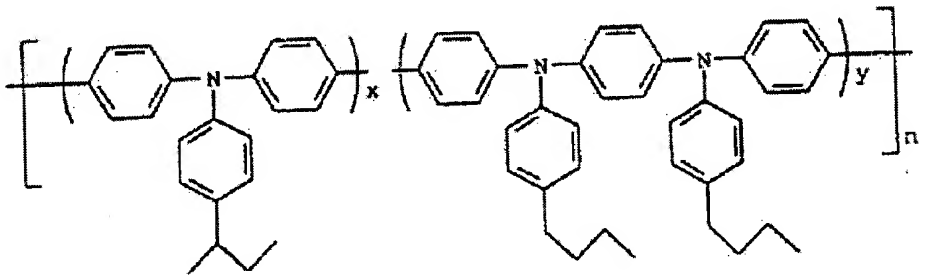
110. (New) An organic polymer according to claim 105 which is blended with a light emissive material.

111. (New) An organic polymer according to claim 1 and comprising the first and third regions, and blended with a hole transporting material.

112. (New) An organic polymer according to claim 111, wherein the hole transporting material comprises a poly-triarylamine.

113. (New) An organic polymer according to claim 1 and comprising the second and third regions.

114. (New) An organic polymer according to claim 113, having a formula as shown in Formula XXXVII:



wherein $x + y = 1$, $x \geq 0.5$ and $y \leq 0.5$ and $n \geq 2$.

115. (New) An organic polymer according to claim 113 which is blended with an electron transporting material.

116. (New) An organic polymer according to claim 115, wherein the electron transporting material comprises poly-fluorene.

117. (New) An electroluminescent device comprising an anode layer, a cathode layer, and a layer of an organic polymer situated between the anode layer and the cathode layer, the organic polymer having a plurality of regions along the length of the polymer backbone and comprising two or more of the following:

(i) a first region for transporting negative charge carriers and having a first bandgap defined by a first LUMO level and a first HOMO level; and

(ii) a second region for transporting positive charge carriers and having a second bandgap defined by a second LUMO level and a second HOMO level; and

(iii) a third region for accepting and combining positive and negative charge carriers to generate light and having a third bandgap defined by a third LUMO level and a third HOMO level, wherein each region comprises one or more monomers and the quantity and arrangement of the monomers in the organic polymer is selected so that the first, second and third bandgaps are distinct from one another in the polymer, and wherein the device includes an emissive material which may or may not be the third region, and the first LUMO level lies between a work function of the cathode and a LUMO level of the emissive material or which is matched to the LUMO level of the emissive material, and the second HOMO level lies between a work function of the anode

and a HOMO level of the emissive material or which is matched to the HOMO level of the emissive material.